THE

ONTARIO WATER RESOURCES

COMMISSION

LOWER GRAND VALLEY AREA

REGIONAL STUDY

OF

WATER SUPPLY REQUIREMENTS

1965

LOWER GRAND VALLEY AREA

REGIONAL STUDY

OF

WATER SUPPLY REQUIREMENTS

DATA

FROM

ONTARIO WATER RESOURCES COMMISSION

FILES

MARCH 1965

NICE
GRA
LOW
ASZF

aszf

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

WATER TREATMENT PLANTS ON LAKE ERIE

TABLE OF CONTENTS (Cont'd)

APPENDIX I

ESTIMATES PREPARED BY DESIGN APPROVALS BRANCH, DIVISION OF SANITARY ENGINEERING

APPENDIX II

INFORMATION PROVIDED BY DESIGN APPROVALS BRANCH, DIVISION OF SANITARY ENGINEERING

CITY OF BRANTFORD

AREA SERVED

1) City of Brantford
2) Portion of Township of Brantford

EXISTING FACILITIES

Source of Supply

Holmedale Canal which receives water from the upstream side of Wilkes Dam on the Grand River.

Intake Crib

Dimensions - 8 ft. by 8 ft. by 9 ft.
Screen on each side of top 3 ft. -8-0.5 in. diameter Everdur bars at 9-inches c. to c.

Intake

Dimensions - 48-in. diameter reinforced concrete pipe
Length - 320 ft.

Pre-Chlorinators (two)

2 - Fischer & Porter gas chlorinators (Model C1410) each with a maximum capacity of 1000 pounds per day with the present orifices.

1 - Fairbanks-Morse weigh scale capable of handling two ton cylinders of chlorine and equipped with Bristols loss-in-weight recorder.

The chlorine is injected through a diffuser located in a 48-inch diameter intake pipe.

Screen Chamber

Dimensions - 22.67 ft. by 21.33 ft. by 10.5 ft. (max.w.d.)
Capacity - 5070 cu.ft. or 31,600 gal. (max.w.d.) or 6.0ft.(min.w.d)
- 2900 cu.ft. or 18,100 gal. (min.w.d.)
Screens - 2.75-inch by 2.75-inch stainless steel mesh (0.080 wire)
- two screens in series, each screen being 6.08 ft. by 4.42 ft.

Chlorine Activated Silica Feeder ("Silactor")

1 - Wallace and Tiernan V-notch gas chlorinator (Series A-731) with a maximum capacity of 400 pounds per day with the present orifice.

1 - Wallace and Tiernan solution feed pump (Series A-747) with a maximum capacity of 250 U.S. gallons per day. This unit will feed sodium silicate slurry to the "Silactor".

1 - Wallace and Tiernan "Silactor" (Series A-768)

The chlorine-activated silica can be fed to the water in the screen house.

Raw Water Conduits (two)

Dimensions - two - 30-inch diameter reinforced concrete pipes carry the raw water from the screen chamber to the pre-treatment tanks.

Pre-Treatment Tanks (two)

Dimensions - 2 - each 180.33 ft. by 72.00 ft. by 9.4 ft. (max.w.d.)
The tanks are formed of earthen embankments and lined with asphalt.

Capacity - 62,000 cu.ft. or 387,000 gal. each (max.w.d.)
- 124,000 cu.ft. or 774,000 gal. total (max.w.d.)
or - 30,400 cu.ft. or 189,500 gal. each (min.w.d.)
- 60,800 cu.ft. or 379,000 gal. total (min.w.d.)

The south tank has air diffusers located in the centre of the unit, while in the north tank, the air is released around the edges.

Mixing Chambers (two)

Dimensions - 2-each 10.17 ft. by 10.00 ft. by 10.00 ft. (w.d.)
Capacity - 1017 cu.ft. or 6350 gal. each
2034 cu.ft. or 12,700 gal. total

One chamber is provided in the east end of each pre-treatment tank. Each chamber is equipped with a "Lightnin" mixer.

Air Blowers (two)

1 - Roots-Connersville blower (Type RAS-60-4VM) size 8 by 16 equipped with a Burgess-Manning Snubber and driven by a G.E. electric motor rated at 60 HP at 1175 rpm or 30 HP at 590 rpm.

1 - Roots-Connersville blower (Type RAS-60-4VM) size 8 by 16 equipped with a Burgess-Manning Snubber and driven by a 60 HP Turner electric motor.

The units supply air to the pre-treatment tanks.

Carbon Slurry Tanks (three)

Dimensions - 3-each 21 ft. by 21 ft. by 13 ft. (w.d.)
Capacity - 5730 cu.ft. or 35,700 gal. each
- 17,190 cu.ft. or 107,100 gal. total

Each slurry tank is equipped with a "Lightnin" mixer.

Carbon Feeder

1 - BIF Omega carbon slurry feeder (Model 88 BA-7)

The carbon is fed to the mixing chambers at the end of the pre-treatment tanks.

Pre-Treated Water Conduits (two)

Dimensions - two - 30-inch diameter reinforced concrete pipes transfer the water from the pre-treatment tanks to the low lift pump-well.

Low Lift Pump-Wells (two)

Dimensions - 1 - 19.17 ft. by 16.00 ft. by 12.33 ft. (w.d.)
- 1 - 14.50 ft. by 16.00 ft. by 12.33 ft. (w.d.)
Capacity - 3780 cu.ft. or 23,600 gal.
- 2860 cu.ft. or 17,850 gal.
Total - 6640 cu.ft. or 41,450 gal.

Low Lift Pumps (three)

3 - Worthington vertical turbine pumps each rated at 4860 gpm (7 mgd) at a head of 27 ft. and each driven by a 60 HP Tamper electric motor.

Water Conduit

Dimensions - 1 - 36-inch diameter concrete pressure pipe carries the water from the low lift pumps to the flash mixing chamber.

Pre-Ammoniator

1 - Wallace and Tiernan mechanical-diaphragm pressure-type ammoniator (Series A-347) with a maximum capacity of 35 lb. per 24 hours (present orifice). The ammonia can be fed to the water in the line between the low lift pumps and the flash mixer.

Activated Silica Feeder

1 - Schuttle and Koerting Co. Rotameter. The activated silica is fed to the line between the low lift pumps and the flash mixer.

Sodium Silicate Storage Tank

Dimensions - 13.25 ft. by 13 ft. by 16 ft. (hopper bottom)
Capacity - 1760 cu.ft.

Sodium Silicate and Sulphuric Acid Mixing Tank (Activated Silica)

Dimensions - 6 ft. by 5 ft. by 9 ft. (l.d.)
Capacity - 270 cu.ft. or 1683 gal.

Activated Silica Day Tanks (two)

2 - 500 gallon steel day tanks are provided in the chemical storage room. Portable mixers are provided on both tanks.

Old Intake

Dimensions - 36-inch diameter concrete pipe

Old Raw Water Pump-Well

Dimensions - 26 ft. in diameter by 34 ft. deep

Old Low Lift Pumps (Three)

1 - Allis-Chalmers vertical centrifugal pump rated at 3335 gpm at a head of 32 ft. and driven by a 50 HP Harland electric motor.

1 - Allis-Chalmers vertical centrifugal pump rated at 5000 gpm at a head of 32 ft. and driven by a 50 HP Harland electric motor.

1 - Allis-Chalmers vertical centrifugal pump rated at about 5000 gpm at a head of 32 ft. and driven by a 60 HP Harland electric motor. These pumps can deliver raw water to the flash mixing chamber.

Flash Mixing Chamber

Dimensions - 11 ft. by 11 ft. by 17.75 ft. (w.d.)
Capacity - 2145 cu.ft. or 13,400 gal.
- The flash mixing chamber is equipped with a "Lightnin" mixer.

Alum Feeder

1 - Liquid alum feeder with solenoid plug valves. The alum solution is fed to the flash mixing chamber.

Liquid Aluminum Sulphate Storage Tank

Dimensions - 13.25 ft. by 13 ft. by 16 ft. (hopper bottom)
Capacity - 1760 cu.ft. or 11,000 gal.

Lime Feeders (Two)

2 - Lime Slurry feed pumps
The lime (calcium hydrate) is fed to the flash mixing chamber.

Lime Storage Tanks (Two)

Dimensions - 2 - each 11.0 ft. in diameter by 19.67 ft.(s.w.d)
(25.0 ft. overall height)
Capacity - 2066 cu.ft. or 12,900 gal. each
- 4132 cu.ft. or 25,800 gal. total

Lime Slurry Day Tank

Dimensions - 8.5 ft. in diameter by 6.0 ft.
Capacity - 340.5 cu.ft. or 2120 gal.
A mixer is provided on the tank.

Lime Slurry Recirculating Pumps (Two)

2 - Allen Sherman Hoff pumps each rated at gpm at a head of ft. and each driven by a 15 HP G.E. electric motor.

Flocculation Chambers (One old and four new)

Old

Dimensions - about 57.75 ft. by 10.00 ft. by 7.25 ft. (w.d.)
Capacity - 4,180 cu.ft. or 26, 150 gal.

New

Dimensions - 4 each 13.09 ft. by 13.00 ft. by 17.00 ft. (w.d.)
Capacity - 2890 cu.ft. or 18,000 gal.each
- 11,560 cu.ft. or 72,000 gal. total
Total Capacity - 15,740 cu.ft. or 98,150 gal.

Settling Tanks (Three)

Dimensions - 1 - 107.42 ft. by 26.21 ft. by 17.62 ft. (w.d.)-new
2 - each 106.08 ft. by 29.33 ft. by 7.25 ft. (w.d.) - old
Capacity - 49,600 cu.ft. or 310,000 gal. (new)
- 22,500 cu.ft. or 140,000 gal. each (old)
- 45,000 cu.ft. or 280,000 gal. total (old)
Total Capacity - 94,600 cu.ft. or 590,000 gal.

Filters (Eight)

Dimension - 6 - each 20.0 ft. by 17.5 ft. (old)
2 - each 24 ft. by 22 ft. (new)
Area - 6 - each 350 sq.ft. or 2100 sq.ft.
2 - each 528 sq.ft. or 1056 sq.ft.
Total - 3156 sq.ft.

Backwash Pump

1 - vertical turbine pump rated at approximately 6000 gpm at a head of 40 ft. and driven by a 100 HP U.S. electric motor.

Clear Water Wells (Two)

New Well

Dimensions - 49.25 ft. by 25.50 ft. by 8.00 ft. (w.d.)
Capacity - 10,400 cu.ft. or 62,600 gal.

Old Well

Dimensions - 118.50 ft. by 31.50 ft. by 10.83 ft. (w.d.)
Capacity - 40,500 cu.ft. or 252,300 gal.

Clear Water Reservoir

Dimensions - 130.83 ft. by 113.92 ft. by 8.79 ft. (w.d.)
Capacity - 130,900 cu.ft. or 815,000 gal.

Sulfonators (Two)

1 - Wallace and Tiernan sulfonator with a maximum capacity of 100 lb. per day (present orifice).

1 - Wallace and Tiernan sulfonator with a maximum capacity of 30 lb. per day (present orifice).

Sulphur dioxide is purchased in ton cylinders and can be fed to the clear water reservoir for dechlorination.

Post-Chlorinators (Two)

1 - Wallace and Tiernan bell jar type gas chlorinator (Series A-419) with a maximum capacity of 60 lb. per day (present orifice).

1 - Wallace and Tiernan bell jar type gas chlorinator (Series A-419) with a maximum capacity of 30 lb. per day (present orifice).

The post-chlorine solution can be fed to the clear water reservoir if the chlorine residual requires an increase.

2 - Fairbanks-Morse weigh scales each capable of handling two, ton cylinders of chlorine and each equipped with a Bristols loss-in-weight recorder. One scale is used normally, with the second scale as a standby for either pre- or post-chlorine usage.

Post-Ammoniator

1 - Wallace and Tiernan mechanical-diaphragm pressure-type ammoniator (Series A-347) with a maximum capacity of 50 lb. per 24 hours (present orifice). The ammonia can be fed to the treated water near the exit from the clear water reservoir.

Liquid Ammonia Storage Tank

1 - Liquid ammonia storage container with a capacity of 1750 U.S. gallons.

Fluoride Feeder

1 - Wallace and Tiernan semi-automatic gravimetric dry chemical feeder (Type M.O.F.). Sodium silicofluoride is fed to the water in the clear wells. The rate of dosage is controlled by the high lift pumpage.

High Lift Pumps (Five)

1 - Allis-Chalmers single stage horizontal centrifugal pump rated at 3380 gpm at a head of 210 ft. and driven by a 250 HP English electric motor.

1 - Babcock-Wilcox and Goldie McCulloch two stage horizontal centrifugal pump rated at about 4860 gpm at a head of 210 ft. and driven by a 400 HP Westinghouse electric motor.

1 - DeLaval single stage horizontal centrifugal pump rated at 5400 U.S. gpm at a head of 225 ft. and driven by a 400 HP English Electric "Motor-Generator" (298 KVA output, 575 Volts, 60 cycle, 2 phase, 299 Amps) which in turn can be driven by a 480 HP Buda diesel engine.

2 - Allis-Chalmers single stage horizontal centrifugal pumps each rated at 4000 gpm at a head of 225 ft. and each driven by a 360 HP Mirrlees Bickerton and Day diesel engine.
These units are utilized for standby purposes.

Generator

1 - Westinghouse generator (312 KVA, 600 Volts, 60 cycle, 3 phase, 300 Amps) driven by a 360 HP Mirrlees Bickerton and Day diesel engine. This unit provides power to all units except the high lift pumps in the event of a power failure.

Instrumentation

1 - Honeywell screen chamber water level indicator and recorder.

1 - Builders (old) raw water flow recorder, totalizer and indicator.

1 - Wallace and Tiernan free chlorine residual recorder on the water in the pre-treatment tanks.

1 - Browser turbidimeter (indicator) on the water in the pre-treatment tanks.

1 - Honeywell air flow input to pre-treatment tanks indicator and recorder.

1 - Wallace and Tiernan free chlorine residual recorder on the water leaving the low lift pumps.

1 - Builders (new) raw water flow recorder totalizer and indicator on the water leaving the low lift pumps.

1 - Honeywell treatment unit water level indicator on the water in the settling tanks.

1 - Beckman pH indicator on the water in the settling tanks.

1 - Honeywell clear well water level indicator.

1 - Wallace and Tiernan free chlorine residual recorder on the water at the entrance to the high lift pumps.

1 - Builders water flow recorder, totalizer and indicator on the high lift diesel driven pumps discharge (20-inch Dall Tube).

1 - Fischer and Porter water flow indicator and totalizer 20-inch Venturi leading to city.

1 - Fischer and Porter water flow indicator and totalizer from 18-inch Venturi leading to city.

1 - Fischer and Porter water flow recorder on water being pumped to city through the above two Venturis.

1 - Builders water level in No. 1 elevated tank (0.5 mg) indicator and recorder.

1 - Honeywell water level in No.2 elevated tank (0.5 mg) recorder.

1 - Builders water flow from the Albion Street Pumping Station totalizer, indicator, and recorder.

1 - Evershed water level recorder on the water in the Park Road Pumping Station concrete reservoir.

1 - Evershed water pressure recorder on the water leaving the Park Road Pumping Station.

Air Compressors for Plant Instruments (Two)

2 - DeVilbiss rotary air compressors each rated at cfm at psi and each driven by a 7.5 HP Tamper electric motor.

Distribution System Storage

2 - 500,000 gallon steel elevated tanks (Nos. 1 & 2)
1 - 1,000,000 gallon concrete ground level reservoir (Park Road).

Albion Street Booster Pumping Station

Pumps (Three)

1 - Weinman horizontal centrifugal pump rated at 985 gpm at a head of 58 ft. and driven by a 20 HP Robbins and Myers electric motor.

1 - Allis-Chalmers horizontal centrifugal pump rated at 700 gpm at a head of 140 ft. and driven by either a 60 HP G.E. electric motor or an automatically started 100 HP Cummins diesel engine.

1 - horizontal centrifugal pump rated at 2,220 gpm at a head of ft. and driven by a 125 HP Marland electric motor.

The pumps obtain suction from the main, and discharge to the main.

Instrumentation

2 - Pressure recording gauges on the water pressure entering and leaving the booster station.

2 - Pressure indicating gauges on the water pressure entering and leaving the booster station.

1 - BIF flow indicating device from a 10-inch Venturi.

Park Road Reservoir and Pumping Station

Reservoir (Reinforced Concrete)

Dimensions - 120.00 ft. by 96.67 ft. by 14 ft. (w.d.)
Capacity - 162,200 cu.ft. or 1,012,000 gal.

Pumps (two)

1 - Allis-Chalmers horizontal centrifugal pump rated at 700 gpm at a head of 140 ft. and driven by a 60 HP G.E. electric motor.

1 - Worthington horizontal centrifugal pump rated at 2160 U.S. gpm at a head of 150 ft. and driven by either a 125 HP English electric motor or a 100 HP Dorman diesel engine.

Instrumentation

1 - Trigon reservoir water level indicator.

Distribution System

Approximately 120 miles of cast iron, cast iron-concrete lined, asbestos-cement and copper mains ranging in size from 1 to 24 inches in diameter.

Services

There are approximately 14,300 metered services and 1,010 hydrants on the system.

RAW WATER QUALITY

(Grand River)

No. of Samples		1961 1	1962 8	1963 2	1964 1
Hardness as $CaCO_3$ (ppm)					
	Average	296	263	310	296
	Maximum		348	370	
	Minimum		174	250	
Alkalinity as $CaCO_3$ (ppm)					
	Average	224	190	197	180
	Maximum		244	246	
	Minimum		140	148	
Iron as Fe (ppm)					
	Average	0.54	0.84	0.19	0.40
	Maximum		2.60	0.22	
	Minimum		0.22	0.16	
Chloride as Cl (ppm)					
	Average	22	30	27	37
	Maximum		54	27	
	Minimum		12	26	
pH at OWRC Lab.					
	Average	7.9	8.2	8.0	7.8
	Maximum		9.2	8.2	
	Minimum		7.8	7.8	
Apparent Colour Units					
	Average	40	21	20	10
	Maximum		30	20	
	Minimum		5	20	
Turbidity Units					
	Average	5.5	18.2	2.6	7.0
	Maximum		74.0	3.8	
	Minimum		2.6	1.4	
					10 samples
Coliforms per 100 ml (M.F.)					
Logarithmic	Average	160	1,793	1,118	687
	Maximum		30,000	3,100	7,600
	Minimum		80	500	82

WATER PUMPAGE

Year	Total Pumpage (Million Gallons)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1960	2,146.814	9.325	-	5.886
1961	2,231.335	9.025	-	6.113
1962	2,303.418	10.010	-	6.310
1963	2,594.445	11.970	4.630	7.108

OTHER AVAILABLE INFORMATION

1. There are several reports by the firm of James F. MacLaren Limited, Consulting Engineers on the existing water supply system.

2. OWRC Water Resources Survey, County of Brant, 1964.

3. Cost estimates prepared by the Design Approvals Branch of the Division of Sanitary Engineering dated October 1964 are included as Appendix I.

TOWNSHIP OF BRANTFORD

AREA SERVED

1) Wyndham Hills - Area No. 1
2) Tutela Heights - Area No. 2
3) Cainsville - Area No. 3
4) Airport - Area No. 4
5) Poplar Hills Subdivision

EXISTING FACILITIES

1) Wyndham Hills - Area No. 1

Source (One Well)

Depth - 125 ft.
Diameter - 6 inch
Pump - 1 - Layne vertical turbine pump with a rated capacity of 150 gpm at ft. head and driven by a 10 HP U.S. Holloshaft electric motor.

Aeration (for H_2S Removal)

2 - Sheldon Co. blowers supply air to the water as it cascades over baffles into the storage reservoir.

Reservoir

Dimensions - 40 ft. by 40 ft. by 11.5 ft. (w.d.)
Capacity - 18,400 cu.ft. or 115,000 gallons

High Lift Pumps (two)

1 - Layne vertical turbine pump with a rated capacity of 250 gpm at ft. head and driven by a 15 HP U.S. Holloshaft electric motor.

1 - Layne vertical turbine pump with a rated capacity of 350 gpm at ft. head and driven by either a 30 HP electric motor or a 6 cylinder Continental gasoline engine.

Recorder

1 - Bristol Recorder

Chlorination

A hypochlorinator is reportedly available at the Township of Brantford's Work Shop.

Elevated Tank

Capacity - 250,000 gallons.

Services

Commercial - 23
Domestic - 422

2) Tutela Heights - Area No. 2

Source (One Well)

Depth - 30 feet
Diameter - 10 inch
Pump - Layne vertical turbine pump with a rated capacity of 150 gpm at ft. head and driven by a 5 HP U.S. Holloshaft electric motor.

Reservoir

Dimensions - 40 ft. by 40 ft. by 10 ft.
Capacity - 16,000 cu.ft. or 100,000 gallons

High Lift Pumps (Three)

1 - Canadian Allis-Chalmers centrifugal pump with a rated capacity of 100 gpm at 173 ft. head and driven by a 10 HP Canadian Allis-Chalmers electric motor.

1 - Canadian Allis-Chalmers centrifugal pump with a rated capacity of 110 U.S. gpm at 150 ft. head and driven by a 7.5 HP Canadian Allis-Chalmers electric motor.

1 - Canadian Allis-Chalmers centrifugal pump with a rated capacity of 350 gpm at 228 ft. head, dual driven by either a 50 HP Canadian Allis-Chalmers electric motor or a 6 cylinder 50 HP Bedford diesel engine.

Meter

A 4-inch Trident Crest meter is provided on the discharge of the high lift pump.

Chlorination

A Precision (Model S) Chemical feed pump with a capacity of 0 - 60 U.S. gpd is available for feeding hypochlorite solution if required. The feed pump was not connected at the time of the inspection.

Distribution System

- 4.47 miles of 8 in. asbestos cement
- 0.94 miles of 6 in. asbestos cement
- 5.41 miles total

Services

There are approximately 72 services and 35 hydrants on the system.

3) Cainsville - Area No. 3

Source

Water is obtained from the City of Brantford

Elevated Tank

333,000 gallon tank rides on the distribution system

Distribution System

There are approximately 3.88 miles of cast iron mains ranging from 6 to 10 inches in diameter.

Services

The system supplies approximately 78 services.

4) Airport - Area No. 4

Source (One Well)

Depth - 45 ft.
Diameter - 12 inches
Rated Capacity - 100 gpm
Operating Level at time of test - 19 ft. 2 inches below the base.
Pump - A Johnston vertical turbine pump with a rated capacity of gpm at ft. head, and driven by either a 7.5 HP International electric motor or a Fairbanks-Morse (Model FM-Y) gasoline engine.

Meter

A 2 inch Trident Meter is available at the pumphouse.

Reservoir

Dimensions - ft. by ft. by 10 ft. 6 inches (w.d.)
Capacity - 20,200 cu.ft. or 125,000 gallons

High Lift Pumps

1 - Smart-Turner centrifugal pump with a rated capacity of 133 gpm at 115 ft. head and driven by a 10 HP electric motor.

1 - Allis-Chalmers centrifugal pump with a rated capacity of 750 U.S. gpm at 175 ft. head and driven by a 50 HP Hydro Electric conversion motor.

Standby Pump

1 - Cameron pump with a rated capacity of 1000 gpm at 208 ft. head and driven by a 6 cylinder Buda gasoline engine.

Pressure Tank

1 - 500 gallon pressure tank (estimated)

Services

The system serves five industries which are as follows:

1) Bluebird Coach Co.
2) Brant Norfolk Flying Club
3) Ruff-Clarkson Steel Co.
4) York-Farms (lavatories only)
5) Sporting Goods Co.

5) Poplar Hills Subdivision

No. 1 Pumphouse and Well

Well

Depth - 70 ft.
Diameter - 8 inch.
Capacity -
Well Pump - Johnston vertical turbine pump with a rated capacity of gpm at ft. head and driven by a 7.5 HP Tamper electric motor.

Pressure Tank

Capacity - 3000 U.S. gallons (2500 Imp.gal.)

Storage Tank

Dimensions -
Capacity - 100,000 U.S. gallons (83,300 Imp.gal.)

Standby Pump

1 - Smart-Turner centrifugal pump with a rated capacity of 250 gpm at a head of ft. and driven by a 4 cylinder Wisconsin gasoline engine.

Chlorinator

1 - Surechlor venturi type hypochlorinator with a maximum feed rate of 9 oz. per hour is available but not used.

No. 2 Pumphouse and Well

Well

Depth - 84 ft.
Diameter - 8 inch.
Capacity - 100 gpm
Pump - Johnston vertical turbine pump with a rated capacity of gpm at ft. head and driven by a 7.5 HP U.S. Holloshaft electric motor.

Services

There are approximately 70 services on the system.

RAW WATER QUALITY

(1) Wyndham Hills - Area No. 1 (One Well)

		1961	1962	1963	1964	1965
No. of Samples		1	1	1	1	1
Hardness as $CaCO_3$ (ppm)		230	610	544	570	612
Alkalinity as $CaCO_3$ (ppm)		146	182	178	176	178
Iron as Fe (ppm)		0	0.22	0.13	0.29	0.10
Chloride as Cl (ppm)		16	21	12	6	12
pH at OWRC Lab.		8.2	7.5	8.0	7.5	7.9
Coliforms per 100 ml (M.F.)			3 Samples			
	Logarithmic Average	0	1			0
	Maximum	-	3			
	Minimum	-	0			

RAW WATER QUALITY (Cont'd)

(2) Tutela Heights - Area No. 2 (One Well)

		1962	1963	1964
No. of Samples		3	1	2
Hardness as $CaCO_3$ (ppm)				
	Average	241	236	233
	Maximum	244	-	236
	Minimum	238	-	230
Alkalinity as $CaCO_3$ (ppm)				
	Average	205	206	176
	Maximum	210	-	194
	Minimum	202	-	158
Iron as Fe (ppm)				
	Average	0.07	0.24	0.05
	Maximum	0.10	-	0.10
	Minimum	0.05	-	0.00
Chloride as Cl (ppm)				
	Average	9	4	7
	Maximum	13	-	8
	Minimum	7	-	5
pH at OWRC Lab.				
	Average	7.8	8.1	8.0
	Maximum	8.0	-	8.1
	Minimum	7.5	-	7.9
Coliforms per 100 ml (M.F.)				
Logarithmic	Average	2	0	0
	Maximum	11	-	0
	Minimum	0	-	0

RAW WATER QUALITY (Cont'd)

(3) Cainsville - Area No. 3

- see City of Brantford - Grand River Water Quality

(4) Airport - Area No. 4

	1964	1965
No. of Samples	1	1
Hardness as $CaCO_3$ (ppm)	262	260
Alkalinity as $CaCO_3$ (ppm)	204	210
Iron as Fe (ppm)	0.78	3.77 (from Hydrant)
Chloride as Cl (ppm)	15	20
pH at OWRC Lab.	7.6	8.0
Coliforms per 100 ml (M.F.)	0	0

(5) Poplar Hills Subdivision

	1962	1963	1964
No. of Samples	1	1	1
Hardness as $CaCO_3$ (ppm)	302	296	302
Alkalinity as $CaCO_3$ (ppm)	244	224	242
Iron as Fe (ppm)	0.22	0.20	0.09
Chloride as Cl (ppm)	28	19	24
pH at OWRC Lab.	7.5	7.9	7.7
Coliforms per 100 ml (M.F.)		0	0

WATER PUMPAGE

(1) Wyndham Hills - Area No. 1

Year	Total Pumpage (mill.gal.)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1961	NA	NA	NA	NA
1962	NA	NA	NA	NA
1963	20.200	NA	NA	0.055
1964	NA	NA	NA	NA

(2) Tutela Heights - Area No. 2

Year	Total Pumpage (mill.gal.)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1961	NA	NA	NA	NA
1962	3.235	NA	NA	0.009
1963	4.093	NA	NA	0.011
1964	4.575	NA	NA	0.013

(3) Cainsville - Area No. 3

Year	Total Pumpage (mill.gal.)	Average Day (mgd)
1963	14.380	0.039
1964	NA	NA

(4) Airport - Area No. 4

Year	Total Pumpage (mill.gal.)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1961	NA	NA	NA	NA
1962	NA	NA	NA	NA

(4) Airport - Area No. 4 (Cont'd)

Year	Total Pumpage (mill.gal.)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1963	NA	NA	NA	NA
1964	7.357	NA	NA	0.020

(5) Popular Hills Subdivision

Year	Total Pumpage (mill.gal.)	Maximum Day (mgd)	Minimum Day (mgd)	Average Day (mgd)
1961	NA	NA	NA	NA
1962	NA	NA	NA	NA
1963	5.100	NA	NA	0.014
1964	NA	NA	NA	NA

OTHER AVAILABLE INFORMATION

1. OWRC Water Resources Survey, County of Brant, 1964.

TOWN OF CALEDONIA

AREA SERVED

Town of Caledonia

EXISTING FACILITIES

Source

Six Wells

Main Supply

Well No. 1

Depth - 18.5 ft.
Casing - 8-inch
Pump - 1 - Canada pump rated at 300 U.S. gpm at a head of 210 ft. and driven by a HP electric motor.

Well No. 2

Depth - 19.08 ft.
Casing - 8-inch
Pump - 1 - Smart-Turner pump rated at 300 U.S. gpm at a head of 180 ft. and driven by a HP electric motor.

Well No. 3

Depth - 19.83 ft.
Casing - 8-inch
Pump - 1 - Smart-Turner pump rated at 500 gpm at a head of ft. and driven by a HP gasoline engine.

Storage

Elevated tank
Capacity - 50,000 gallons

Chlorination

Wallace and Tiernan gas chlorinator
Capacity - 10 lb/24 hr.

Emergency Supply

Source*

Three Wells

Depth - 20 ft.
Casing - 2-inch diameter
Pump - 1 - pump rated at 300 gpm at a head of 185 ft. and driven by a Wisconsin 4 cylinder gasoline engine.

The pump is connected by a common suction from the wells.

Chlorinator

- Fischer and Porter gas chlorinator with an orifice capacity of 10 lb/24 hr.
- Application point at suction of pump

Meter

- Trident Crest meter on discharge of pump

* - This supply will be equipped with a new pump and chlorinator during 1965.

Distribution System

The system consists of 8.25 miles of cast iron pipe with diameter size ranging from 8 to 4 inches and 1.18 miles of asbestos cement pipe ranging from 6 to 4 inches diameter.

Services

Domestic - 557
Commercial - 227
Industrial - 1
Hydrants - 60

RAW WATER QUALITY

		1961	1962		1963		1964
Well Number		1	1	2	1	2	
No. of Samples		2	1	1	1	1	1
							Emergency Supply (Well)
Hardness as $CaCO_3$ (ppm)							
	Average	1345	1330	990	1348	1044	1470
	Maximum	1370					
	Minimum	1320					
Alkalinity as $CaCO_3$ (ppm)							
	Average	250	260	240	264	262	262
	Maximum	254					
	Minimum	246					
Iron as Fe (ppm)							
	Average	0.20	0.16	0.16	2.00	0.56	1.00
	Maximum	0.33					
	Minimum	0.08					
Chloride as Cl (ppm)							
	Average	18	22	27	29	27	16
	Maximum	18					
	Minimum	18					
pH at Lab.							
	Average	7.5	7.9	7.4	7.4	7.5	7.2
	Maximum	7.6					
	Minimum	7.4					
Sulphates as SO_4 (ppm)							
	Average	865			1087	695	1135
	Maximum	1100					
	Minimum	630					
Coliform Organisms per 100 ml (M.F.)							
Logarithmic	Average	0	0	0	0	0	0
	Maximum	0	0	0	0	0	0
	Minimum	0	0	0	0	0	0

WATER PUMPAGE

Year	Total Pumpage (gal.)	Maximum Day (gpd)	Minimum Day (gpd)	Average Day (gpd)
1961	72,131,000	406,000	107,000	197,000
1962	62,090,000	472,000	NA	170,000
1963	71,666,100	464,000	NA	168,000
1964	63,956,000	436,000	181,000	175,000

OTHER AVAILABLE INFORMATION

1. Letter to OWRC from Phillips and Roberts Limited, Consulting Engineers dated July 10,1964
   Re: Emergency Supply

2. OWRC Report -"Water Levels in Municipal Wells" dated April 15, 1964.

VILLAGE OF CAYUGA

AREA SERVED

1) Village of Cayuga
2) Portion of Township of Cayuga North

EXISTING FACILITIES

Supply

The source of supply for the Cayuga Water Works is by gravity from the Grand River through a 15-inch corrugated iron intake. The intake extends 113' into the river from the intake well.

Low Lift Pump-Well

The dimensions of the low lift pump-well are 19 ft. by 7.5 ft. by 2.08 ft. deep. It was reported that the depth of the pump-well had been reduced by about 18" according to the specifications. From the intake well, water flows over a weir to the pump suction chamber.

Low Lift Pump

One 200 U.S. gpm Smart-Turner single stage centrifugal pump with vertical drive by a 15 HP electric motor. This pump is presently being operated 24 hours daily. It is expected that a time-clock device will be provided at a future date. Pressure at the pumphouse is maintained at 70 lb.

"Accelapak" Treating Tank and Mechanism

Raw water from the low lift pump-well is transported to an Infilco (Canada) Limited "Accelapak" through a 6-inch cast iron main. The treating tank and internal mechanism is constructed to permit operation at a continuous rate of 200 U.S. gpm.

The apparatus in the treating tank includes primary and secondary mixing and reaction chambers; a separation chamber; and means for producing a mixing and circulation with return flow from the separation chamber to the primary mixing chamber. The treating unit is capable of completely re-suspending the slurry within five minutes after shut-down.

The raw water and the chemicals required for treatment are combined in the primary mixing chamber with large volumes of continually returned slurry formed as a result of treatment. Clarified water is displaced upwardly from the separation chamber to the clarified water outlets at the top of the tank.

Automatic Water Control

An automatic water control of the constant rate type is provided, consisting of a diaphragm valve, controller head box with orifice, needle-type pilot float valve, strainer, pressure reducing valve, pressure release valve and equipment for proper operation.

The discharge orifice is of such size that under the constant head maintained by the control float, the raw water discharge to the tank is equal to the rated capacity of the treating unit.

Chemical Slurry Feeding Equipment

A wet chemical mixer and feeder is provided for mixing and feeding hydrated lime. The feeder tank is semi-cylindrical and is equipped with plow-shaped agitators set on a horizontal shaft and revolved in a vertical plane. The horizontal shaft also revolves a set of chemical measuring orifice cups in a vertical plane which are self-cleaning and discharge a measured quantity of chemical mixture to a discharge funnel and to the treating tank.

A manual variator is provided for changing the rate of feeder discharge. This manual variator consists of an adjustable cut-off shield above the collector funnel. A control lever on the outside of the feeder tank positions the shield to provide any desired feed rate between 0 and 100 per cent of rated capacity.

Coagulant and Hypochlorite Feeders

Two 114-gallons capacity solution tanks, agitator, supporting stand and inter-connecting hose are provided. A Wallace and Tiernan chemical feeder with a scale setting of 1.0-6.0 is provided to supply aluminum sulphate solution and a Wallace and Tiernan hypochlorinator with a scale setting of 1.0-6.0 is

used to add sodium hypochlorite solution. Chlorine and alum solutions are introduced to the raw water in the primary mixing chamber.

Surge Tank

Clarified water from the accelapak overflows through clarified water outlets at the top of the tank to a steel surge tank, 8 ft. in diameter by 10.50 ft. or 3,300 gallons capacity.

Booster and Backwash Pumping Equipment

One 200 U.S. gpm Smart-Turner single stage centrifugal pump at a head of 200 ft. with a 20 HP electric motor is provided. This pump may be used for supplying water from the surge tank to the filters and distribution system or for filter backwashing.

Filter

Two Infilco vertical pressure filters with rated capacities of 100 U.S. gpm each are installed. Sand filter medium is used.

Backwashing of the filters is carried out when the pressure differential between the inlet and outlet of the filters is 5 lb. or about every 3 days.

Reservoir

One standpipe with a capacity of 185,000 gallons.

Distribution System

The distribution system consists of 8.75 miles of cast iron pipe ranging in size from 6 inches to 4 inches in diameter.

Services

Domestic - 300
Commercial - 11
Industrial - 2
Hydrants - 27

RAW WATER QUALITY

		1961	1962	1964
No. of Samples		2	3	1
Hardness as $CaCO_3$ (ppm)				
	Average	262	287	262
	Maximum	268	308	
	Minimum	256	276	
Alkalinity as $CaCO_3$ (ppm)				
	Average	176	184	174
	Maximum	190	198	
	Minimum	162	176	
Iron as Fe (ppm)				
	Average	1.3	0.51	1.92
	Maximum	1.4	0.76	
	Minimum	1.2	0.36	
Chloride as Cl (ppm)				
	Average	23	33	19
	Maximum	25	36	
	Minimum	21	31	
pH at Lab.				
	Average	8.2	8.2	8.1
	Maximum		8.5	
	Minimum		7.8	
Apparent Colour Units				
	Average		12	30
	Maximum	10	15	
	Minimum	5	10	
Turbidity Units				
	Average			36
	Maximum	20	31	
	Minimum	11	18	
Coliform Organisms per 100 ml (M.F.)				
Logarithmic	Average			
	Maximum	90	1100	3400
	Minimum			

WATER PUMPAGE

Year	Total Pumpage (gallons)	Maximum Day (gpd)	Minimum Day (gpd)	Average Day (gpd)
1961	NA	NA	NA	NA
1962	13,800,000	NA	NA	38,000
1963	19,456,000	149,700	NA	53,000
1964	NA	NA	NA	NA

OTHER AVAILABLE INFORMATION

1. "Preliminary Report on Improvements to the Domestic Water Supply System for the Municipality of the Village of Cayuga" - October 2, 1952

   by - Kilborn Engineering Co. Ltd.,
   Consulting Engineers.

2. "Municipal Water Works" (Routine Report) April 15, 1964. Re: Presence of Phenols in Raw Water
   By: Ontario Water Resources Commission

VILLAGE OF HAGERSVILLE

AREA SERVED

Village of Hagersville

EXISTING FACILITIES

Source

Two drilled wells pumping through 1.25 miles of 6-inch transite pipe to the ground-water reservoir.

Well No. 1 (Nichol)

Depth - 290 ft.
Casing - 8-inch diameter steel
Pump - 350 gpm Layne turbine, 25 HP electric drive

The operation is controlled by the level in the ground reservoir.

Well No. 2 (Nichol)

Depth - 115 ft.
Casing - 10-inch diameter steel
Pump - 200 gpm Peerless, 20 HP electric drive and for emergency purposes may be belt driven, manually operated.

Pumphouse

2 - 250 gpm Smart-Turner single stage centrifugal pumps equipped with 25 HP drives. These pumps are operated on alternate days, automatically controlled by the level in the elevated tank.

1 - 500 gpm Smart-Turner single stage centrifugal pump, Chrysler gasoline engine.

Chlorination

Wallace and Tiernan gas chlorinator, 50 lb/day capacity applies chlorine to the common line from the wells and is automatically controlled by the well operation.

Reservoirs

1 - 57,000 gallon concrete ground storage reservoir at the pumphouse.

1 - 166,000 elevated tank

Distribution System

The distribution system consists of 6 inch to 1 inch diameter cast iron pipe. The total length of pipe was not known.

Services

Domestic - 528
Commercial - 47
Hydrants - 55

RAW WATER QUALITY

See page 36.

WATER PUMPAGE

Year	Total Pumpage (gallons)	Maximum Day (gpd)	Minimum Day (gpd)	Average Day (gpd)
1961	NA	222,600	NA	NA
1962	47,783,700	NA	NA	130,000
1963	47,703,700	303,400	NA	129,000
1964	54,073,000	230,000	137,000	147,000

OTHER AVAILABLE INFORMATION

1. "The Village of Hagersville, Ontario, on Water Works System" - August 1, 1956.
   By Proctor and Redfern, Consulting Engineers.

2. "Report on Water Quality and Water Treatment for the Village of Hagersville, Ontario" - August 1, 1963.
   By Proctor and Redfern, Consulting Engineers.

3. "Water Quality Survey of Hagersville Water Supply" May 1, 1964.
   By Ontario Water Resources Commission.

RAW WATER QUALITY

Well Number		1961 1	1961 2	1962 1	1962 2	1963 1	1963 2	1964 1	1964 2
No. of Samples		1	2	1	1	1	1	2	3
Hardness as $CaCO_3$ (ppm)	Average	1590	1495	1580	1510	1590	1440	1135	1175
	Maximum		1560					1330	1220
	Minimum		1430					940	1130
Alkalinity as $CaCO_3$ (ppm)	Average	230	212	234	234	210	214	227	244
	Maximum		236					236	244
	Minimum		188					218	244
Iron as Fe (ppm)	Average	0.2	0.29	1.50	1.0	6.20	2.00	1.05	0.49
	Maximum		0.32					1.40	0.58
	Minimum		0.24					0.70	0.40
Chloride as Cl (ppm)	Average	52	60	64	65	58	64	44	46
	Maximum		73					51	46
	Minimum		47					38	46
pH at Lab.	Average	7.4	7.3	7.1	7.2	7.3	7.4	7.2	7.2
	Maximum		7.4					7.2	7.3
	Minimum		7.1					7.1	7.2
Sulphates as SO_4	Average	1232	1200	1300	1250	1387	1276	879	925
	Maximum		1300					1050	957
	Minimum		1000					708	893

VILLAGE OF JARVIS

AREA SERVED

Not Applicable

EXISTING FACILITIES

There is no municipal system constructed in the village. Water is derived from private wells.

RAW WATER QUALITY

Not Applicable

WATER PUMPAGE

Not Applicable

OTHER AVAILABLE INFORMATION

1. "Sanitary Survey - Village of Jarvis, County of Haldimand" - October 29, November 7, November 20 and December 5, 1963.
   Re: Bacteriological Quality of Well Water
   By Ontario Department of Health

2. Letter to OWRC from Newton, Dickson and Associates Ltd., June 17, 1964. Re: Summary of preliminary report on water and sewage requirements.

3. Memo from G. R. Trewin to K. H. Sharpe dated September 23, 1963.
   Re: Results of Test Drilling Programme

4. Ground Water Survey Report - 1958
   By Ontario Water Resources Commission

TOWNSHIP OF ONEIDA

There are no communal water systems in this township.

TOWNSHIP OF ONONDAGA

There are no communal water systems.

TOWNSHIP OF TOWNSEND

A portion of the township receives water from the Town of Simcoe system.

TOWNSHIP OF TUSCARORA

There are no communal water systems.

TOWNSHIP OF WALPOLE

There are no communal water systems.

TOWNSHIP OF WOODHOUSE

There are seven private water supply systems which are as follows:

1) Adelina Park Subdivision

Water from Lake Erie is filtered and chlorinated before distribution to nine services.

2) Avalon Park

Water from Lake Erie is filtered and chlorinated before distribution to 22 cottages.

3) Crescent Bay

Water from Lake Erie is chlorinated and distributed to 18 services.

4) Lakeshore Cottages

Water from Lake Erie is chlorinated and distributed to seven cottages.

5) Lucas Summer Resort

Water from Lake Erie is chlorinated and supplied to four cottages.

6) Norfolk County Park

Well water is charcoal-filtered and chlorinated before distribution to a park system.

7) Vaughan Subdivision

Water from Lake Erie is filtered and chlorinated prior to distribution to 35 services.

Part of the township also receives water from the Town of Simcoe water system.

WATER TREATMENT PLANTS ON LAKE ERIE

UNION WATER TREATMENT PLANT

Raw Water Quality

		1961	1962	1963	1964
No. of Samples		2	2	1	1
Hardness as $CaCO_3$ (ppm)					
	Average	127	115	202	126
	Maximum	134	116		
	Minimum	120	114		
Alkalinity as $CaCO_3$ (ppm)					
	Average	89	93	214	90
	Maximum	92	94		
	Minimum	86	92		
Iron as Fe (ppm)					
	Average	1.40	1.42	0.38	0.79
	Maximum	-	2.40		
	Minimum	-	0.43		
Chloride as Cl (ppm)					
	Average	21	37	7	21
	Maximum	22	20		
	Minimum	19	17		
pH at OWRC Lab.					
	Average	8.3	8.4	7.9	8.6
	Maximum	8.3	8.6		
	Minimum	8.2	8.1		
Apparent Colour Units					
	Average	10			<10
	Maximum	-			
	Minimum	-			
			12 Samples		
Turbidity Units					
(at Plant Lab)	Average	19.9	16.7	16.4	16.9
	Maximum	150.0	57.0	57.0	85.0
	Minimum	1.0	8.0	8.0	6.0
		12 Samples	9 Samples	12 Samples	3 Samples
Coliforms /100 ml (M.F.)					
Logarithmic	Average	170	101	210	25
	Maximum	4300	930	930	230
	Minimum	4	4	15	4

Intake

Length - 1,500 ft. (bell mouth to low lift pump-well)
Elevation of bell mouth - 559.36 ft.

Treatment Provided

a) screening
b) micro-straining
c) pre-chlorination
d) coagulation (alum and activated silica and carbon) and sedimentation (Graver solids contact unit-Reactivator)
e) rapid sand filtration
f) post-chlorination

Chemical Consumption

Year	Total Pumpage (Million Gallons)	Activated Carbon Total (lb)	Activated Carbon Average Dosage (ppm)	Alum Total (lb)	Alum Average Dosage (ppm)	Chlorine Total (lb)	Chlorine Average Dosage (ppm)
1963	1,376.950					37,588	2.73
1964	1,367.655	2,250	0.17	35,384*	12.21	47,160	3.45

* - U.S. gallons of liquid alum consumed (5.4 lb. of dry alum / U.S. gal. of liquid alum)

Treated Water Quality

See page 42.

Operating Problems

No treatment problems have been reported.

Treated Water Quality

No. of Samples	1961 1	1962 2	1963 1	1964 1
Hardness as $CaCO_3$ (ppm)				
Average	130	117	124	128
Maximum		118		
Minimum		116		
Alkalinity as $CaCO_3$ (ppm)				
Average	92	83	88	80
Maximum		84		
Minimum		82		
Iron as Fe (ppm)				
Average	0.0	0.09	0.05	0.10
Maximum		0.13		
Minimum		0.05		
Chloride as Cl (ppm)				
Average	22	21	22	24
Maximum		22		
Minimum		20		
pH at OWRC Lab.				
Average	8.3	7.7	7.7	7.5
Maximum		7.7		
Minimum		7.6		
Apparent Colour Units				
Average				< 5
Maximum				
Minimum				

TOWN OF HARROW

Raw Water Quality

		1962	1963	1964
No. of Samples		3	2	1
Hardness as $CaCO_3$ (ppm)				
	Average	117	116	115
	Maximum	120	127	
	Minimum	112	104	
Alkalinity as $CaCO_3$ (ppm)				
	Average	87	85	87
	Maximum	88	93	
	Minimum	86	76	
Iron as Fe (ppm)				
	Average	0.49	0.45	0.15
	Maximum	0.57	0.76	
	Minimum	0.33	0.13	
Chloride as Cl (ppm)				
	Average	21	27	24
	Maximum	26	32	
	Minimum	19	22	
pH at OWRC Lab.				
	Average	7.7	8.2	8.0
	Maximum	7.9	8.4	
	Minimum	7.6	8.0	
Apparent Colour Units				
	Average	5	5	<5
	Maximum	5	5	
	Minimum	5	5	
Turbidity Units				
(at Plant Lab.)	Average	6.3	7.9	1.0
	Maximum	11.0	18.0	1.3
	Minimum	2.0	2.0	0.7
Coliforms per 100 ml (M.F.)		11 Samples	12 Samples	11 Samples
	Average	31	23	48
	Maximum	900	150	3500
	Minimum	0	0	0

Intake

Length - 1,235 ft. (bell mouth to low lift pump-well)
Elevation of bell mouth - 558.00 ft.

Treatment Provided

a) screening
b) micro-straining
c) chlorination

Chemical Usage

There are no figures available.

Treated Water Quality

Since the only treatments provided are screening, micro-straining and chlorination, the treated water quality is not included as there is little change in the chemical characteristics of the treated water from the raw water.

Operating Problems

No particular operating problems have been experienced.

TOWN OF PORT DOVER

RAW WATER QUALITY

		1961	1962	1963	1964	1965
No. of Samples		3	3	3	1	1
Hardness as $CaCO_3$ (ppm)						
	Average	141	134	123	140	140
	Maximum	158	136	130		
	Minimum	130	132	114		
Alkalinity as $CaCO_3$ (ppm)						
	Average	97	103	95	94	106
	Maximum	100	104	102		
	Minimum	96	102	80		
Iron as Fe (ppm)						
	Average	0.11	0.24	0.85	0.00	0.17
	Maximum	0.32	0.33	2.00		
	Minimum	0.00	0.10	0.27		
Chloride as Cl (ppm)						
	Average	23	22	24	26	32
	Maximum	27	23	31		
	Minimum	20	20	18		
pH at OWRC Lab.						
	Average	8.2	7.8	8.1	7.9	8.3
	Maximum	8.3	8.1	8.2		
	Minimum	8.0	7.6	7.9		
Apparent Colour Units						
	Average	< 5	< 5	6	5	< 5
	Maximum	< 5	< 5	20		
	Minimum	< 5	< 5	< 5		
Turbidity Units						
	Average	3.8	3.9	13.9	1.0	3.5
	Maximum	7.0	5.0	37.0		
	Minimum	1.0	2.9	2.1		
Coliforms per 100 ml (M.F.)						
Logarithmic	**Average**	2	91	322		18
	Maximum	14	300	8,300		
	Minimum	0	38	5		

Intake

Length - 1,500 ft. (approximately)
Elevation of bell mouth - 563 ft. (approximately)

Treatment Provided

a) screening
b) coagulation (alum) and sedimentation (Infilco "Accelator")
c) chlorination
d) pressure filtration

Chemical Consumption

Year	Total Pumpage (gallons)	Alum Usage Total (lb)	Chlorine Usage Total (lb)	Chlorine Usage Average Dosage (ppm)
1961	200,750,000	*	1,200.0	0.60
1962	243,856,000	900 *	2,123.0	0.87
1963	256,250,000	700 *	2,265.5	0.88
1964	243,964,000	100 *	2,369.5	0.97

* - The "Accelator" unit is used infrequently.

Treated Water Quality

See page 47

Operating Problems

A taste and odour problem was experienced for a short interval in 1963. This was apparently caused by algae in the raw water.

TREATED WATER QUALITY

		1961	1962	1963	1964	1965
No. of Samples		2	3	3	1	1
Hardness as $CaCO_3$ (ppm)						
	Average	143	135	127	140	140
	Maximum	154	148	130		
	Minimum	132	126	124		
Alkalinity as $CaCO_3$ (ppm)						
	Average	99	101	92	94	108
	Maximum	100	104	106		
	Minimum	98	98	68		
Iron as Fe (ppm)						
	Average	0.05	0.05	0.51	0.00	0.05
	Maximum	0.10	0.10	1.30		
	Minimum	0.00	0.00	0.07		
Chloride as Cl (ppm)						
	Average	25	22	25	26	32
	Maximum	28	23	33		
	Minimum	22	21	20		
pH at OWRC Lab.						
	Average	8.2	7.9	7.6	7.9	8.2
	Maximum	8.2	8.0	8.1		
	Minimum	8.1	7.8	7.2		
Apparent Colour Units						
	Average	< 5	< 5	< 5	< 5	< 5
	Maximum		< 5	< 5		
	Minimum		< 5	< 5		
Turbidity Units						
	Average	2.4	1.2	10.6	0.7	1.4
	Maximum	4.0	1.8	31.0		
	Minimum	0.7	0.6	0.3		

VILLAGE OF PORT STANLEY

Raw Water Quality

		1961	1962	1963	1964
No. of Samples		4	15	16	12
Hardness as $CaCO_3$ (ppm)					
	Average	140	134	132	137
	Maximum	158	146	138	160
	Minimum	132	124	124	130
Alkalinity as $CaCO_3$ (ppm)					
	Average	73	63	81	90
	Maximum	99	96	100	100
	Minimum	52	24	42	82
Iron as Fe (ppm)					
	Average	0.71	0.85	0.79	0.43
	Maximum	0.92	1.96	3.20	1.40
	Minimum	0.65	0.30	0.10	0.10
Chloride as Cl (ppm)					
	Average	21	23	26	27
	Maximum	22	25	36	40
	Minimum	21	20	22	21
pH at OWRC Lab.					
	Average	7.0	6.9	7.4	7.5
	Maximum	7.9	7.7	7.8	8.1
	Minimum	6.5	6.1	6.4	6.2
Apparent Colour Units					
	Average	<5		<5	<5
	Maximum	<5		5	5
	Minimum	<5		<5	<5
Turbidity Units					
	Average	22.0	25.0	2.7	9.0
	Maximum	32.0	34.0	3.8	42.0
	Minimum	12.0	16.0	0.5	2.5
Coliforms per 100 ml (M.F.)					
Logarithmic	Average		3	3	2
	Maximum		8	5,600	120
	Minimum		0	0	0

N.B. - The raw water samples contain alum and the results should be interpreted with this in mind.

Intake

Length - 2,000 feet (approximately)
Elevation of bell mouth - 555 feet (approximately)

Treatment Provided

a) coagulation (alum and sulphate of ammonia)
b) sedimentation
c) chlorination
d) pressure filtration

Chemical Consumption

Year	Total Pumpage (Gallons)	Alum Usage Total (lb)	Alum Usage Average Dosage (ppm)	Chlorine Usage Total (lb)	Chlorine Usage Average Dosage (ppm)
1961	64,727,000	NA	NA	NA	NA
1962	66,767,000	3,291*	17.35	1,005.0	1.51
1963	70,646,000	18,188	25.74	1,089.0	1.54
1964	NA	NA	NA	NA	NA

* - for October, November and December

Treated Water Quality

See page 50.

Operating Problems

No operating problems have been reported.

TREATED WATER QUALITY

No. of Samples		1961 6	1962 15	1963 18	1964 13	1965 2
Hardness as $CaCO_3$ (ppm)						
	Average	135	132	131	137	143
	Maximum	148	140	142	144	148
	Minimum	116	122	124	130	138
Alkalinity as $CaCO_3$ (ppm)						
	Average	93	85	86	87	94
	Maximum	102	90	100	94	96
	Minimum	84	76	24	78	92
Iron as Fe (ppm)						
	Average	0.18	0.11	0.15	0.10	0.20
	Maximum	0.22	0.27	0.45	0.24	0.22
	Minimum	0.00	0.05	0.00	0.00	0.18
Chloride as Cl (ppm)						
	Average	23	24	25	25	29
	Maximum	25	31	28	28	33
	Minimum	21	20	21	19	24
pH at OWRC Lab.						
	Average	7.6	7.4	7.4	7.6	8.1
	Maximum	7.9	7.7	7.9	8.1	8.1
	Minimum	7.2	7.0	6.3	7.2	8.0
Apparent Colour Units						
	Average	< 5		< 5	< 5	
	Maximum	< 5		< 5	< 5	
	Minimum	< 5		< 5	< 5	
Turbidity Units						
	Average	1.3	1.2	0.4	0.9	
	Maximum	1.5	1.3	0.8	2.1	
	Minimum	1.1	1.0	0.2	0.3	

VILLAGE OF WEST LORNE

Raw Water Quality

	1961	1962	1963	1964
No. of Samples	5	25	13	13
Hardness as $CaCO_3$ (ppm)				
Average	133	129	128	129
Maximum	140	156	136	140
Minimum	130	120	116	90
Alkalinity as $CaCO_3$ (ppm)				
Average	104	97	103	100
Maximum	116	102	108	110
Minimum	98	92	98	94
Iron as Fe (ppm)				
Average	1.54	0.81	0.87	0.98
Maximum	4.00	4.00	3.64	2.73
Minimum	0.00	0.10	0.20	0.18
Chloride as Cl (ppm)				
Average	22	23	23	24
Maximum	23	29	31	30
Minimum	20	21	20	8
pH at OWRC Lab.				
Average	8.0	8.1	8.1	8.1
Maximum	8.2	8.4	8.4	8.4
Minimum	7.8	7.2	7.9	7.8
Apparent Colour Units				
Average	20		6	6
Maximum	20		10	15
Minimum	20		< 5	< 5
Turbidity Units				
Average	40.0		19.2	14.3
Maximum	83.0		42.0	65.0
Minimum	2.0		2.6	1.7
Coliforms per 100 ml (M.F.)				
Logarithmic Average				15
Maximum		700	14	200
Minimum		12	0	2

Intake

Length - 1,200 feet (approximately)
Elevation of bell mouth - not available

Treatment Provided

a) coagulation (alum)
b) sedimentation
c) rapid sand filtration
d) chlorination

Chemical Consumption

Year	Total Pumpage (U.S.Gallons)	Alum Usage Total (lb)	Alum Usage Average Dosage (ppm)	Chlorine Usage Total (lb)	Chlorine Usage Average Dosage (ppm)
1959	79,061,500	24,500	37.2	759	1.15
1960	72,974,200	21,100	34.8	716	1.18
1961	82,673,400	21,600	31.3	885	1.28
1962	102,784,400	28,400	33.2	1,170	1.37
1963	97,855,900	24,100	29.6	1,295	1.59

Operating Problems

No unusual operating problems have been reported.

Treated Water Quality

See page 53.

Treated Water Quality

No. of Samples	1961 5	1962 2	1963 2	1964 1
Hardness as $CaCO_3$ (ppm)				
Average	130	126	127	144
Maximum	144	128	130	
Minimum	124	124	124	
Alkalinity as $CaCO_3$ (ppm)				
Average	90	89	92	90
Maximum	98	92	96	
Minimum	86	86	88	
Iron as Fe (ppm)				
Average	0.16	0.12	0.09	0.11
Maximum	0.49	0.24	0.10	
Minimum	0.00	0.00	0.07	
Chloride as Cl (ppm)				
Average	23	25	28	26
Maximum	25	27	31	
Minimum	21	22	25	
pH at OWRC Lab.				
Average	7.7	7.6	7.8	7.3
Maximum	8.2	7.9	7.9	
Minimum	7.2	7.3	7.8	
Apparent Colour Units				
Average	< 5		< 5	< 5
Maximum			< 5	
Minimum			< 5	
Turbidity Units				
Average	0.6	0.3	0.3	1.1
Maximum	1.0		0.5	
Minimum	0.3		0.1	

VILLAGE OF WHEATLEY

Raw Water Quality

No. of Samples	1962 3	1963 2	1964 2
Hardness as $CaCO_3$ (ppm)			
Average	123	128	124
Maximum	132	132	126
Minimum	116	124	122
Alkalinity as $CaCO_3$ (ppm)			
Average	97	101	93
Maximum	100	104	94
Minimum	96	98	92
Iron as Fe (ppm)			
Average	0.61	0.67	0.72
Maximum	0.98	0.78	1.11
Minimum	0.10	0.55	0.32
Chloride as Cl (ppm)			
Average	22	26	24
Maximum	25	27	25
Minimum	21	24	22
pH at OWRC Lab.			
Average	7.9	7.5	8.1
Maximum	8.1	7.7	8.2
Minimum	7.7	7.2	8.0
Apparent Colour Units			
Average	10	8	<5
Maximum	15	10	<5
Minimum	5	5	<5
Turbidity Units			
Average	5.3	10	7.3
Maximum	7.5	11	11.0
Minimum	4.0	9	3.5

Intake

Old Intake

Length - 1,875 feet (bell mouth to low lift pump-well)
Elevation of bell mouth - 558 feet (approximately)

New Intake

Length - 2,300 feet (bell mouth to low lift pump-well)
Elevation of bell mouth - 554.90 feet

Treatment Provided

a) screening
b) micro-straining
c) coagulation (alum) and sedimentation (Graver solids contact unit)
d) pre-chlorination
e) rapid sand filtration
f) post-chlorination

Chemical Consumption

Year	Total Pumpage (gallons)	Alum Usage Total (lb)	Alum Usage Average Dosage (ppm)	Chlorine Usage Total (lb)	Chlorine Usage Average Dosage (ppm)
1961	90,870,000	7,518	8.2	1,626	1.79
1962	90,670,000	2,300	2.5	1,477	1.63
1963	126,330,000	1,400	1.1	1,864	1.47
1964	NA*	NA*		NA*	

* - Plant renovations underway

Treated Water Quality

See page 56.

Operating Problems

Algae problems have been experienced but the installation of a micro-strainer at this plant has apparently solved these problems.

Problems with frazil ice in the intake have been encountered in the winter seasons of 1961-62 and 1962-63.

Treated Water Quality

No. of Samples	1961 3	1962 4	1963 3	1964 4
Hardness as $CaCO_3$ (ppm)				
Average	124	123	127	123
Maximum	136	128	130	126
Minimum	114	116	124	122
Alkalinity as $CaCO_3$ (ppm)				
Average	97	97	97	92
Maximum	102	102	102	94
Minimum	88	92	94	90
Iron as Fe (ppm)				
Average	0.37	0.42	0.34	0.15
Maximum	1.0	1.00	0.46	0.21
Minimum	0	0.10	0.27	0.10
Chloride as Cl (ppm)				
Average	19	26	24	24
Maximum	23	34	28	24
Minimum	12	22	22	24
pH at OWRC Lab.				
Average	8.0	7.8	7.8	8.0
Maximum	8.1	7.9	7.9	8.0
Minimum	7.8	7.5	7.6	7.9
Apparent Colour Units				
Average		10	8	< 5
Maximum		10	15	< 5
Minimum		10	< 5	< 5
Turbidity Units				
Average	35	14.2	5.3	1.1
Maximum		32.0	6.5	1.8
Minimum		2.6	4.0	0.8

TOWNSHIP OF BERTIE

RAW WATER QUALITY

		1961	1962	1963	1964	1965
No. of Samples		5	9	3	5	2
Hardness as $CaCO_3$ (ppm)						
	Average		130	136		
	Maximum		136	144		
	Minimum		120	130		
Alkalinity as $CaCO_3$ (ppm)						
	Average		100	103		
	Maximum		104	110		
	Minimum		92	92		
Iron as Fe (ppm)						
	Average		0.18	0.24	0.20	0.21
	Maximum		0.43	0.34	0.31	0.28
	Minimum		0.05	0.12	0.10	0.14
Chloride as Cl (ppm)						
	Average		23	22		
	Maximum		29	24		
	Minimum		21	19		
pH at OWRC Lab.						
	Average		7.8	8.0	7.9	8.1
	Maximum		8.2	8.1	8.1	8.2
	Minimum		6.6	7.7	7.8	8.0
Turbidity Units (at Plant Lab.)			12 Samples	12 Samples	12 Samples	
	Average		4.4	4.9	5.3	5.3
	Maximum		15.3	15.3	13.2	8.0
	Minimum		1.3	1.9	2.5	3.7
Coliforms per 100 ml (M.F.)						
Logarithmic	Average	37	53	43	27	13
	Maximum	700	5700	3100	3100	33
	Minimum	0	0	0	0	5

Intake

Length - 1,800 feet (bell mouth to low lift pump-well)
Elevation of bell mouth - 557.50 feet

Treatment Provided

a) screening
b) micro-straining
c) chlorination

Chemical Consumption

Year	Total Pumpage (million gallons)	Chlorine Total (lb)	Chlorine Average Dosage (ppm)
1961	90.762 (Aug. 14 to Dec. 31)	1,666	
1962	346.161	3,563	1.03
1963	387.069	3,676	0.95
1964	381.524	3,936	1.03

Treated Water Quality

Since the only treatments provided are screening, micro-straining and chlorination, the treated water is not included as there is little change in the chemical characteristics of the treated water from the raw water.

Operating Problems

There are none reported.

TOWNSHIP OF DUNN - TOWN OF DUNNVILLE

Water is obtained from Lake Erie and it is micro-strained and chlorinated at the water treatment plant in the Township of Dunn. It is then distributed to two industries and the Town of Dunnville water treatment plant where it receives further treatment before distribution to the town system.

Raw Water Quality

See page 61.

Intake

Township of Dunn

Length - 1,650 feet (bell mouth to low lift pump-well)
Elevation of bell mouth - 548.80 feet

Treatment Provided

Township of Dunn

a) screening
b) micro-straining
c) chlorination

Town of Dunnville

a) chlorine dioxide
b) coagulation (alum and activated silica)
c) sedimentation (activated carbon)
d) anthracite filtration
e) post-chlorination

Chemical Consumption

Township of Dunn

Year	Total Pumpage (million gallons)	Chlorine Total (lb)	Chlorine Average Dosage (ppm)
1961	2245.838	17,961	0.80
1962	3214.853	31,534	0.98
1963	3726.935	30,858	0.83
1964	3637.177	32,478	0.89

Chemical Consumption

Town of Dunnville

Year	Total Pumpage (gallons)	Chlorine		Alum*	
		Total (lb)	Average Dosage (ppm)	Total (lb)	Average Dosage (ppm)
1962	281,721,000	1,500	0.53	NA	NA
1963	286,966,000	1,200	0.42	20,000	7.0
1964	275,529,200	2,250	0.81	27,500	10.0

* - Alum consumption figures are approximate

RAW WATER QUALITY

		1961	1962	1963	1964	1965
No. of Samples		7	12	12	12	2
Hardness as $CaCO_3$ (ppm)						
	Average	132	136	135	138	131
	Maximum	142	143	154	154	142
	Minimum	126	128	125	104	120
Alkalinity as $CaCO_3$ (ppm)						
	Average	99	103	103	103	95
	Maximum	103	106	114	120	104
	Minimum	93	99	99	97	86
Iron as Fe (ppm)						
	Average	0.36	0.45	0.36	0.38	0.65
	Maximum	0.68	0.99	0.69	0.69	1.10
	Minimum	0.00	0.16	0.17	0.15	0.20
Chloride as Cl (ppm)						
	Average	22	24	24	26	26
	Maximum	24	28	28	35	29
	Minimum	21	22	21	21	23
pH at OWRC Lab.						
	Average	7.9	8.0	8.1	8.1	8.1
	Maximum	8.1	8.3	8.2	8.3	8.2
	Minimum	7.7	7.8	8.0	8.0	8.0
Apparent Colour Units						
	Average	7	6	8	8	68
	Maximum	<3	11	15	20	130
	Minimum	15	<5	<5	<5	<5
Turbidity Units		12 Samples				
(at Plant Lab.)	Average	14.8	12.1	21.8	15.4	32.3
	Maximum	132.0	91.0	128.0	95.0	127.0
	Minimum	2.2	2.3	2.3	2.9	5.8
Coliforms per 100 ml (M.F.)						
Logarithmic	Average	27	382	189	253	145
	Maximum	6300	13400	32000	11900	1600
	Minimum	0	0	0	0	32

Treated Water Quality

Town of Dunnville

		1962-1963
No. of Samples		10
Hardness as $CaCO_3$ (ppm)		
	Average	134
	Maximum	156
	Minimum	126
Alkalinity as $CaCO_3$ (ppm)		
	Average	99
	Maximum	102
	Minimum	94
Iron as Fe (ppm)		
	Average	0.16
	Maximum	0.38
	Minimum	0.05
Chloride as Cl (ppm)		
	Average	21
	Maximum	26
	Minimum	23
pH at OWRC Lab.		
	Average	8.0
	Maximum	8.3
	Minimum	7.5
Apparent Colour Units		
	Average	<5
	Maximum	<5
	Minimum	<5
Turbidity Units		
	Average	3.9
	Maximum	10.0
	Minimum	2.6

Operating Problems

Problems with frazil ice in the intake were experienced in January 1962 and 1964.

TOWNSHIP OF RALEIGH

Cedar Springs - Ontario Hospital Water Treatment Plant

Raw Water Quality

No. of Samples		1961 1	1962 1	1963 2	1964 1
Hardness as $CaCO_3$ (ppm)					
	Average	130	124	128	126
	Maximum			130	
	Minimum			126	
Alkalinity as $CaCO_3$ (ppm)					
	Average	98	96	98	100
	Maximum			98	
	Minimum			98	
Iron as Fe (ppm)					
	Average	0.04	0.30	0.18	0.50
	Maximum			0.27	
	Minimum			0.08	
Chloride as Cl (ppm)					
	Average	21	20	24	22
	Maximum			24	
	Minimum			24	
pH at OWRC Lab.					
	Average	8.0	8.1	8.2	8.1
	Maximum			8.3	
	Minimum			8.0	
Apparent Colour Units					
	Average		10		<5
	Maximum				
	Minimum				
Turbidity Units					
	Average	1	2.9	2.4	9.0
	Maximum			3.3	
	Minimum			1.5	
Coliforms per 100 ml (M.F.)			68 Samples	111 Samples	10 Samples
Logarithmic	Average	0	38	3	0
	Maximum		7500	460,000	0
	Minimum		0	0	0

Intake

Length - 2,500 feet (bell mouth to low lift pump-well)
Elevation of top of intake crib - 542 feet (approximately)

Treatment Provided

a) coagulation (alum) and sedimentation
(Graver solids contact unit)
b) rapid sand filtration
c) chlorination

Chemical Consumption

Year	Total Pumpage (gallons)	Alum Usage Total (lb)	Alum Usage Average Dosage (ppm)	Chlorine Usage Total (lb)	Chlorine Usage Average Dosage (ppm)
1961	21,803,500	10,000	45.8	NA	NA
1962	36,320,600	NA	NA	NA	NA
1963	42,417,400	3,603	8.5	826	1.95
1964	*	*	NA	*	NA

* - The Ontario Department of Health commenced supervision of this plant in 1964 and no records after 1963 are available in Commission files.

Treated Water Quality

See page 65.

Operating Problems

Algae in the raw water created problems in the water treatment plant in the summer season of 1962.

Treated Water Quality

No. of Samples		1961 1	1962 2	1963 3	1964 1
Hardness as $CaCO_3$ (ppm)					
	Average	128	129	129	124
	Maximum		132	130	
	Minimum		126	128	
Alkalinity as $CaCO_3$ (ppm)					
	Average	94	88	84	88
	Maximum		90	88	
	Minimum		86	82	
Iron as Fe (ppm)					
	Average	0.02	0.15	0.14	0.00
	Maximum		0.15	0.22	
	Minimum		0.15	0.10	
Chloride as Cl (ppm)					
	Average	22	21	24	24
	Maximum		21	24	
	Minimum		21	23	
pH at OWRC Lab.					
	Average	7.8	7.7	7.6	7.5
	Maximum			7.8	
	Minimum			7.4	
Apparent Colour Units					
	Average		< 5		< 5
	Maximum		< 5		
	Minimum		< 5		
Turbidity Units					
	Average	1	1.3	0.7	1.8
	Maximum		1.5	1.5	
	Minimum		1.1	0.2	

ALGAL CONCENTRATIONS AT WATER WORKS ON LAKE ERIE

Significance of Algae in Water Supplies

It is difficult to make positive statements concerning the relationships between algae populations and filter clogging or taste and odour production, due to the inconstancy of variables that are present in different situations. Nonetheless, some generalizations may be made.

The problems of filter-clogging associated with algae populations will vary with the efficiency of pre-filtration treatment processes. If pre-filtration measures are not adequate, resulting in a large percentage of the algae gaining access to the filters, definite reductions in filtration capacity may be anticipated when levels of diatoms approximating 1,500 to 2,000 areal standard units per millilitre are reached. The problem would become increasingly severe with higher levels of diatoms, and could be compounded by the presence of supplementary populations of blue-green algae or green algae. Levels of blue-green algae, which often are surrounded by a resistant mucilaginous sheath or envelope, in the range of 2,000 to 3,000 areal standard units per millilitre would similarly cause problems with filter clogging. Planktonic green algae in open waters of the Great Lakes rarely constitute any hazard insofar as filter-clogging is concerned.

The production, nature and intensity of algae-causing taste and odours is influenced by the type and numbers of algae that are present. Some of the flagellates such as Synura and Dinobryon may cause extremely perceptible odours at concentrations as low as 150 to 300 areal standard units per millilitre.

Most of the blue-green algae impart a grassy odour to water when they are present at levels in excess of 1,000 to 1,500 a.s.u./ml. However, decomposition will cause the same algae to produce a vile septic odour. Noticeable odours will usually be associated with most diatoms when 1,500 to 3,000 a.s.u./ml are present. Diatoms usually produce a characteristic earthy odour, but a few, like Asterionella, may cause a geranium-like odour at 1,500 to 3,000 a.s.u./ml which changes to a fishy odour with increasing populations. The addition of chlorine often worsens conditions by releasing the odoriferous contents of the algae cell.

With the exception of the odour-producing flagellates, levels of algae from 1,500 to 2,000 a.s.u./ml constitute the general range in which filter-clogging and taste and odour problems will commence.

UNION WATER TREATMENT PLANT

(RUTHVEN)

Concentrations in areal standard units per millilitre (a.s.u./ml)

Date 1962	Blue-Greens	Greens	Flagellates	Diatoms	Total
May 16		159.50	15.10	1666.00	1840.60
Date 1964					
Nov. 9		486.24		1081.54	1567.78
Nov. 16		404.96	12.05	288.47	705.48
Nov. 30	72.53	92.18		174.05	338.86
Dec. 7		393.03		482.04	875.07
Dec. 14		510.56		495.40	1143.50
Dec. 21		134.65	12.05	529.65	676.35
Dec. 29		143.28		453.83	597.11
Date 1965					
Jan. 11	13.04	64.35		1768.11	1845.50
Jan. 18		78.72	6.03	1136.46	1221.21
Jan. 25	39.77	81.73	.98	1231.17	1353.65
Feb. 1	79.43	154.40		1929.75	2163.58
Feb. 8		247.12		1304.11	1551.23
Feb. 15		145.77		1987.23	2133.05
Mar. 1	94.22	55.14	157.60	1148.62	1455.58
Mar. 8	45.47	53.40	328.33	1367.33	1794.53
Mar. 15	69.50	51.38	234.77	2264.61	2620.26

TOWNSHIP OF DUNN WATER WORKS

(TOWN OF DUNNVILLE)

Concentrations in areal standard units per millilitre (a.s.u./ml)

Date 1963	Blue-Greens	Greens	Flagellates	Diatoms	Total
Nov. 14	6.5			140.4	146.9
Dec. 6		10.05		327.35	337.40
Dec. 23				45.83	458.1
Date 1964					
Jan. 4		28.4		509.45	537.85
Jan. 11	22.5	5.5	170.35	239.8	438.10
Jan. 16	12.05	40.12		135.4	187.57
Jan. 25	31.4	69.0		361.3	461.7
Jan. 31		55.7		347.5	403.2
Feb. 11		44.4		123.4	167.8
Feb. 18	11.04	27.9		76.28	115.20
Feb. 29	7.73	239.14		367.24	614.11
Mar. 14	223.6	100.1		82.2	405.9
Mar. 21	249.0	23.4		26.7	299.1
Mar. 27	269.07	99.3		2121.4	4961.4
Apr. 9	1009.0		512.0	8607.0	10128.0
Apr. 15	154.6	101.3		313.6	569.5
Apr. 23	633.4	279.8		282.8	1196.0
Apr. 30	271.4	624.5	90.8	989.1	1975.8
May 6	766.0	351.3	60.0	405.3	1582.6
May 12	137.5	19.2		603.7	710.4
May 22	16.5	97.7	29.96	426.73	570.89
June 2	13.5	129.67	51.2	133.1	257.47
June 9	32.56	386.95	115.45	152.41	636.17
June 18	19.28	205.97	18.54	24.84	268.63
June 25	24.37	96.05	44.84	142.76	308.02
July 3	15.26	25.93	8.28	40.15	89.62
July 8	380.08	46.46	20.79	1.97	449.30
July 17	522.79	626.56	17.62	23.95	1190.92
July 30	488.85	255.10	71.50	63.49	815.59
Aug. 6	748.90	1081.14	22.28	58.84	1911.16
Aug. 15	166.31	762.63	166.23	713.23	2031.28
Aug. 29	109.17	713.22	16.39	599.00	1516.35
Sept. 5	31.91	401.67	103.71	204.41	703.70
Sept.12	168.92	241.70	157.51	452.93	1021.11
Sept.22	17.79	125.20	4.48	98.64	246.08
Sept.29	18.47	77.62	38.09	56.07	190.25

TOWNSHIP OF DUNN WATER WORKS (CONT'D.)

Date 1964	Blue-Greens	Greens	Flagellates	Diatoms	Total
Oct. 8	46.17	223.17	71.40	556.58	897.32
Oct. 15	5.26	279.27	120.65	1108.52	1513.70
Oct. 21	369.60	215.31	25.76	249.26	859.93
Oct. 29	118.14	281.19	42.87	335.4	177.60
Nov. 3	129.63	178.99	174.57	243.20	962.80
Nov. 11	110.46	72.57	599.93	72.77	855.73
Nov. 18	100.82	120.24	5.13	312.22	538.41
Nov. 26	36.95	17.58	22.23	262.43	339.19
Dec. 3	95.34	198.93	22.56	1085.26	1402.09
Dec. 11	18.20	201.54	3.01	354.80	577.55
Dec. 17	90.90	110.34		1527.84	1729.08
Dec. 24	101.13	24.63	20.12	324.87	470.75
Date 1965					
Jan. 1	75.58	143.02	5.97	620.99	845.56
Jan. 6	39.20	120.47	1.75	412.36	573.78
Jan. 13	9.60	193.31	4.70	543.89	751.50
Jan. 21		240.70	33.30	416.09	684.09
Feb. 1	15.50	281.30	78.70	109.15	484.65
Feb. 5	24.05	476.06	33.05	195.55	728.71
Feb. 13		485.50	334.95	2030.50	2850.95
Feb. 22	40.35	224.68	9.4	291.25	562.68
Feb. 28		282.88	9.21	526.68	808.77
Mar. 11	34.00	54.31	66.42	292.74	441.47
Mar. 18	26.60	75.12	36.85	332.25	470.82

APPENDIX I

ONTARIO WATER RESOURCES COMMISSION

Division of Sanitary Engineering — Design Approvals Branch
October 1964

MUNICIPALITY: Village of Jarvis
Town of Simcoe
Village of Cayuga
Village of Hagersville
Town of Caledonia
City of Brantford
Twp. of Brantford

Re: WATER SUPPLY PIPELINE TO SERVE THE ABOVE MUNICIPALITIES

This study gives an estimate of the required capacity of a water purification plant, located in the vicinity of Nanticoke on Lake Erie and a pipeline from there to Brantford with branches to the above municipalities enroute.

Cost estimates are also included. These costs have been based on staged development of the pipeline and have been pro-rated to apply to the year of construction approximately as noted in each case.

POPULATION PROJECTIONS

	Present 1964	Stage I 1975	Stage II 1985	Stage III 2014
Village of Jarvis	762	900	1,000	1,250
Town of Simcoe	9,866	10,100	11,300	14,700
Village of Cayuga	961	1,040	1,220	1,650
Village of Hagersville	2,046	2,700	3,050	3,900
Town of Caledonia	2,355	3,200	3,750	5,100
City of Brantford	54,917	62,200	68,000	86,000
Twp. of Brantford	8,092	10,800	13,200	20,000

These population figures were calculated on the basis of past growth trends and also considering expected land use.

... continued

WATER CONSUMPTION

Based on an average per capita water consumption of 125 gallons per day under normal conditions and assuming that the demand on the maximum day would be 1.65 times the average, the following summary of expected consumption figures was tabulated:

Municipality	Year	Population	Avg. Day	Max. Day
Village of Jarvis	1975	900	112,500	180,000
	1985	1,000	125,000	200,000
	2014	1,250	156,500	250,000
Town of Simcoe	1975	10,100	1,262,500	2,020,000
	1985	11,300	1,412,500	2,260,000
	2014	14,700	1,837,500	2,940,000
Village of Cayuga	1975	1,040	130,000	208,000
	1985	1,220	152,500	244,000
	2014	1,650	206,250	330,000
Village of Hagersville	1975	2,700	337,500	540,000
	1985	3,050	381,250	610,000
	2014	3,900	487,500	780,000
Town of Caledonia	1975	3,200	400,000	640,000
	1985	3,750	468,750	750,000
	2014	5,100	637,500	1,020,000
City of Brantford	1975	62,200	7,775,000	12,440,000
	1985	68,000	8,500,000	13,600,000
	2014	86,000	10,750,000	17,200,000
Twp. of Brantford	1975	10,100	1,262,500	2,020,000
	1985	13,200	1,650,000	2,640,000
	2014	20,000	2,500,000	4,000,000

Stage I - 1975: - - Total average daily consumption - 11,280,000 gal.
Total maximum daily consumption - 18,048,000 "

Stage II - 1985: - - Total average daily consumption - 12,690,000 "
Total maximum daily consumption - 20,304,000 "

Stage III - 2014: - - Total average daily consumption - 16,575,250 "
Total maximum daily consumption - 26,800,000 "

... continued

PROPOSED WATER SUPPLY SYSTEM

Intake Site

The selected intake site is south and west of the mouth of the Nanticoke Creek in Lake Erie. This site was chosen after studying the hydrographic charts of the north shore of Lake Erie in the area south of the City of Brantford. The exact location is shown on the appended map.

With an intake 2,500 feet in length, a water depth of 30 feet can be reached at this location.

A review of the results of the chemical analysis of raw water samples taken at the Port Dover water works over the past few years would apparently indicate that the quality of the raw water in this area is acceptable. Complete treatment of the raw water will be necessary of course. There is also a possibility that microstraining may be essential due to excessive algae concentrations in the raw water. Sampling at the proposed intake site will determine this however.

Intake Size

The intake in this instance has been designed on the basis of a minimum allowable velocity of flow from 2 to 3 fps with the velocity through the intake crib 0.5 fps maximum. Therefore, the following pipe sizes and intake crib areas are necessary.

Intake Pipe

- Assuming an allowable drawdown of 10'-0" in the low lift pump well, the friction losses in the line would be 10 feet in 2,500 feet or 4 feet per 1000 feet.

- Assuming a Hazen-Williams roughness coefficient of 140 and the minimum velocity of 2 fps the pipe size required would be -

STAGE	FLOW	PIPE SIZE	VELOCITY	H_L/1000
I	33.45 cfs	30 in.	2.95 fps	3.5 ft.
II	37.63 cfs	30 in.	3.00 fps	4.0 ft.
III	49.67 cfs	36 in.	2.90 fps	3.3 ft.

Intake Crib

The cross sectional area of the intake crib required would be as follows assuming a maximum velocity of 0.5 fps.

STAGE	FLOW	AREA REQ'D
I	33.45 cfs	66.90 ft^2
II	37.63 cfs	75.32 ft^2
III	49.67 cfs	99.34 ft^2

Purification Plant

The capacity of the water purification plant necessary for each stage would be that capable of meeting the maximum daily demand. Therefore the following plant capacities would be necessary:

STAGE		CAPACITY
I	- - -	18,048,000 gpd
II	- - -	20,304,000 gpd
III	- - -	26,800,000 gpd

Pipeline

The proposed pipeline is shown on the second appended map.

This scheme envisages a direct high pressure pipeline from Lake Erie in the vicinity of the community of Nanticoke to the City of Brantford. The route to be followed would be north from Nanticoke along Sideroad No. 7 to the east of Nanticoke to the Old Indian Line. From this point the pipeline would continue across right of ways through the Tuscarora Indian Reserve and cross the Grand River, following the river into the City of Brantford to the site of the existing water works.

The municipalities wishing to obtain water from the pipeline would be served by reservoirs and low pressure pipelines supplied by the main line. This proposal would then parallel the Lake Huron - London pipeline.

High Pressure Pipeline Size

STAGE I

- Design flow - 33.45 cfs (18,048,000 gpd)
- Maximum static head - 120 feet
- Total length Lake Erie to Brantford - 168,200 feet

Assume discharge pressure of 250 psi at Lake Erie and zero residual pressure at Brantford

then total head loss = 577.5 feet (250 psi) - 120 feet
= 457.5 feet

head loss/1000 ft. = 2.72 feet

Using an alignment chart for flow in pipes (Hazen-Williams Formula) and a roughness coefficient of 140 the pipe size required would be

33 inch diameter

It should be noted that this choice of pipe is based on a uniformly increasing static head from 600 feet at the lake to 720 feet in Brantford. Actually the maximum 720 foot elevation occurs in the vicinity of Hagersville with the terminal elevation at Brantford being 650 feet. Also some of the flow would not be pumped all the way to Brantford but would be diverted to any other participating municipalities en route. In any case the pipe size determined is approximately correct for the Stage I demands.

STAGE II

- Design flow - 37.63 cfs (20,304,000 gpd)
- Maximum static head - 120 feet
- Total length Lake Erie to Brantford - 168,200 feet

Assuming a discharge pressure in the pipeline at the lake of 250 psi and zero residual pressure at Brantford

then the total head loss = 577.5 (250 psi) - 120 feet
= 457.5 feet
or 2.72 feet/1000 ft. of length

Once again making the same basic assumptions as were noted in the Stage I design and using the same alignment chart, the approximate pipe size would be

33 inch diameter

STAGE III

- Design flow - 49.67 cfs (26,800,000 gpd)
- Maximum static head - 120 feet
- Total length Lake Erie to Brantford - 168,200 feet

Assuming a discharge pressure in the pipeline at the lake of 250 psi and zero residual pressure at Brantford

then the total head loss = 577.5 (250 psi) - 120 feet
= 457.5 feet
or 2.72 feet/1000 ft. of length

Making similar assumptions to those made in Stages I and II, the required pipe size would be

36 inch diameter

Pressure Calculations

Assuming the 36 inch diameter main, the pressures expected at various points on the pipeline were checked to determine whether the basic assumptions made in the preliminary calculations resulted in serious errors.

Once again the alignment chart for flow in pipes (Hazen-Williams Formula) was used and a roughness coefficient of 140.

a) Pressure at Jarvis

STAGE I flow - 33.45 cfs

Friction loss/1000 ft. in 36 in. pipe - 1.5 ft.
Distance lake to Jarvis - 39,300 ft.
∴ total friction loss - 59 ft.
static head - 90 ft.
∴ total head loss 149 ft. or 64.5 psi

The discharge pressure at the lake was 250 psi
∴ residual pressure at Jarvis = 185.5 psi

STAGE II flow - 37.63 cfs

Friction loss/1000 ft. in 36 in. pipe - 1.95 ft.
Distance lake to Jarvis - 39,300 ft.
∴ total friction loss - 76.5 ft.
static head - 90 ft.
∴ total head loss 166.5 ft. or 72 psi

The discharge pressure at the lake was 250 psi
∴ the residual pressure at Jarvis for Stage II would be 178 psi

STAGE III flow - 49.67 cfs

Friction loss/1000 ft. in 36 in. pipe - 3.20 ft.
Distance lake to Jarvis - 39,300 ft.
∴ total friction loss - 126 ft.
static head - 90 ft.
∴ total head loss 216 ft. or 93.5 psi

With the discharge pressure 250 psi at the lake, the residual pressure at Jarvis would be 156.5 psi

b) Pressure at Hagersville

STAGE I flow - the flow is now reduced assuming that the Town of Simcoe and the Villages of Jarvis and Cayuga have exerted their demands on the system
∴ flow is 28.99 cfs.

Friction loss/1000 ft. in 36 in. pipe	-	1.15 ft.
Distance Jarvis to Hagersville	-	35,100 ft.
∴ total friction loss	-	40.5 ft.
static head	-	30 ft.
∴ total head loss		70.5 ft. or 30.5 psi

With a pressure at Jarvis of 185.5 psi for the Stage I flow the residual pressure at Hagersville would be 155.5 psi.

STAGE II flow - 32.62 cfs deducting the Stage II flows at Jarvis.

Friction loss/1000 ft. in 36 in. pipe	-	1.6 ft.
Distance Jarvis to Hagersville	-	35,100ft.
∴ total friction loss	-	56ft.
static head	-	30ft.
∴ total head loss		86 ft. or 37.2 psi

With a pressure at Jarvis of 178 psi for the Stage II flow, the residual pressure at Hagersville would be 140.8 psi.

STAGE III

- flow 43.15 cfs - after deducting Stage III flows at Jarvis

Friction loss/1000 ft. in 36 in. pipe	-	2.5 ft.
Distance Jarvis to Hagersville	-	35,100 ft.
∴ total friction loss	-	88 ft.
static head	-	30 ft.
∴ total head loss	-	118 ft. or 51 psi

With a pressure at Jarvis of 156.5 psi for the Stage III flow, the residual pressure at Hagersville would be 105.5 psi.

c) Pressure at Brantford

STAGE I

- flow 27.97 cfs - after deducting the Stage I flow for Hagersville

Friction loss/1000 ft. in 36 in. pipe	-	1.05 ft.
Distance Hagersville to Brantford	-	93,800 ft.
∴ total friction loss	-	98.5 ft.
static head (GAIN)	-	70 ft.
∴ total head loss		28.5 ft. or 12.3 psi

Therefore, with the pressure at Hagersville being 155.5 psi for the Stage I flow, the residual pressure at Brantford would be 143.2 psi

STAGE II

- flow 31.49 cfs - after deducting the Stage II flow for Hagersville

Friction loss/1000 ft. in 36 in. pipe	-	1.30 ft.
Distance Hagersville to Brantford	-	93,800 ft.
∴ total friction loss	-	122 ft.
static head (GAIN)	-	70 ft.
∴ total head loss		52 ft. or 22.5 psi

With a pressure at Hagersville of 140.8 psi for the Stage II flow, the residual pressure at Brantford would be 118.3 psi.

STAGE III

- flow 41.18 cfs - after deducting the Stage III flow for Hagersville

Friction loss/1000 ft. in 36 in. pipe	-	2.20 ft.
Distance Hagersville to Brantford	-	93,800 ft.
∴ total friction loss	-	206 ft.
static head (GAIN)	-	70 ft.
∴ total head loss	-	136 ft. or 59 psi

Therefore with a pressure of 105.5 psi at Hagersville for the Stage III flow, the residual pressure at Brantford would be 46.5 psi.

Therefore with a discharge pressure of 250 psi at the lake, the maximum day demand for a 50 year design period could be delivered to Brantford by a 36 inch diameter high pressure pipeline.

Similar exercises were done for 30 inch and 33 inch diameter pipelines. However only the 10 and 20 year design period maximum day demands could be delivered by each of these respectively, with a 250 psi discharge pressure.

It would appear that the basic assumptions made in the preliminary calculations were justified.

COST ESTIMATES

STAGE I

The cost estimates for Stage I are based on a comparison with today's cost projected to the year 1965. Both the intake and the pipeline have been sized to accommodate the maximum day demand for the 50 year design period.

CAPITAL COSTS

INTAKE

Size	- 36 inch diameter	
Length	-2500 feet	
Cost per foot	- $100.00	
	TOTAL COST	$ 250,000.00

TREATMENT PLANT AND HIGH LIFT PUMPING STATION

Capacity	- 18,048,000 gpd	
Cost	- 19.2 cents per gallon	
	TOTAL COST	3,465,000.00

PIPELINE

Size	- 36 inch diameter	
Length	- 168,200 feet	
Cost	- $30.00 per foot	
	TOTAL COST	5,046,000.00
STAGE I Capital Cost	-	$ 8,761,000.00
Engineering & Contingencies 20%		1,752,200.00
	TOTAL COST	$10,513,200.00

ANNUAL COSTS

Capital	-	$ 896,000
Operating Costs		
Pipeline - power		20,600
- maintenance		15,000
Purification plant		170,000
	TOTAL	$ 1,101,600

STAGE II

The capital costs for the pipeline and intake remain unchanged of course. The only cost involved here is the expansion of the purification plant to 20,304,000 gpd.

The cost quoted is a comparison with today's cost projected to the year 1975 when it is assumed the expansion will be undertaken.

TREATMENT PLANT AND HIGH LIFT PUMPING STATION EXPANSION

Additional capacity required - 2,256,000 gpd
Cost .28 cents per gallon

	Sub Total	$ 631,700
Engineering and Contingencies 20%		126,300
	TOTAL	$ 758,000

ANNUAL COST STAGE II

Capital Cost	Stage I	$ 896,000
	Stage II	63,700
Operating Costs		
Pipeline - power		$ 28,800
- maintenance		15,000
Purification plant		185,000
	TOTAL	$ 1,188,500

It may be preferable to construct a 20,304,000 gallon plant initially rather than provide an extension after 10 years. The costs of Stage I and II would then be as follows:

CAPITAL COST

INTAKE		$ 250,000
Purification Plant and High Lift		3,898,400
Pipeline		5,046,000
Engineering and Contingencies 20%		1,838,900
	TOTAL	$11,033,300

...continued

ANNUAL COST

STAGE I (1965 to 1975)

Capital Cost		$ 941,000
Operating Cost		
Pipeline - power		20,600
- maintenance		15,000
Purification Plant		170,000
	TOTAL	$ 1,146,600

STAGE II (1975 to 1985)

Capital Cost		$ 941,000
Operating Cost		
Pipeline - power		28,800
- maintenance		15,000
Purification plant		185,000
	TOTAL	$ 1,169,800

STAGE III

Again, the only cost involved will be that for enlarging the plant to 26,800,000 gpd. The cost for this increase in capacity has been pro-rated to the year 1985.

TREATMENT PLANT AND HIGH LIFT PUMPING STATION EXPANSION

Additional capacity required	-	6,496,000 gallons
Cost	-	39 cents per gallon
Sub Total	-	2,533,400
Engineering and Contingencies	20%	506,700
TOTAL		$3,040,100

ANNUAL COST - STAGE III

Capital cost - STAGE I		$ 896,000
STAGE II		63,700
STAGE III		259,000
Operating costs		
Pipeline - power		52,700
- maintenance		15,000
Purification plant		218,000
TOTAL		$1,504,400

...continued

If the 20,304,000 gpd plant for Stage I and II were constructed initially the annual cost for Stage III would be

Capital Cost - STAGE I and II		$ 941,000
STAGE III		259,000
Operating Costs (as above)		285,700
	TOTAL	$ 1,485,700

It should be noted that an additional capital cost may be involved if the raw water quality necessitates the provision of microstraining for algae control.

SUMMARY OF CAPITAL COSTS

STAGE	POPULATION	CONSUMPTION AVG. DAY	CONSUMPTION MAX. DAY	$ CAPITAL COST
I	90,940	11,280,000	18,048,000	10,513,200
II	101,520	12,690,000	20,304,000	758,000
III	132,600	16,575,250	26,800,000	3,040,100
			TOTAL	$ 14,311,300

SUMMARY OF ANNUAL COSTS

The capital costs have been based on 30 year debentures. Therefore a large portion of the annual cost would disappear after 1994. The annual costs could be summarized as follows:

PERIOD	ANNUAL COST	
1965-1974	$ 1,101,600	
1975-1984	1,188,500	
1985-1994	1,504,400	
1995-2004	608,400	
2005-2014	544,700	
2015-	285,700	(operating cost only)

Alternative Staging

If Stage I and II were constructed simultaneously, the following changes would result in the summary of capital and annual costs.

CAPITAL COSTS

STAGE	POPULATION	CONSUMPTION AVG. DAY	CONSUMPTION MAX. DAY	$ CAPITAL COST
I	90,940	11,280,000	18,048,000	11,033,300
II	101,520	12,690,000	20,304,000	--
III	132,600	16,575,250	26,800,000	3,040,100
			TOTAL	$ 14,073,400

The net result is a capital saving of $237,900.

...continued

ANNUAL COSTS

PERIOD	COST
1965-1974	$1,146,600
1975-1984	1,169,800
1985-1994	1,485,700
1995-2004	544,700
2005-2014	544,700
2015-	285,700 (operating cost only)

This alternate staging increases the annual cost over the first ten years in comparison with the original staging. However the annual cost for the next thirty years is less than the annual cost over the same period for the original staging.

SUMMARY

It must be stated that this report presents a proposal and determines an estimated cost for supplying Lake Erie water to the City of Brantford. The route outlined for the pipeline need not necessarily be the most suitable. A detailed field survey would be necessary to determine this.

Similarly although the selected intake site requires the shortest length of intake to reach a water depth of thirty feet, in the final analysis it may prove more desirable to locate the supply works on the east side of Nanticoke Creek.

In any case the estimated costs for the project will not be significantly changed by any of the above alternatives.

APPENDIX II

Determination of Annual Cost

Annual Capital Cost

Interest Rate	-	5.75 per cent
Debt retirement rate	-	2.018 per cent
Reserve fund	-	0.75 per cent
TOTAL		8.518 per cent

Operating Cost

(a) pipeline maintenance/year - 0.25% of the capital cost.

(b) pipeline power cost/year - derived from the following formula:

$$1 \text{ kw} = 0.113 \, Qh$$

where

Q = flow in the pipeline in cfs
h = total head loss along the length of the pipeline

and the pump efficiency is taken to be 75%

# of kw hr per year	-	8,766
cost per kw hr	-	$0.0075

(c) purification plant operating cost is obtained from a prepared graph of water treated vs cost per mgd.